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ABSTRACT

Computers are being used with increasing frequency to plan campus design and evaluate the effectiveness of existing facilities. This review surveys documents, previously announced in RIE, that are concerned with the development, application, and evaluation of computer programs and simulation models designed to relate space and enrollment needs to less tangible aesthetic and social requirements. (Author)

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Use of Computers in Planning Higher Educational Facilities

PHILIP K. PIELE

Planning the collegiate environment of the future is a task that must encompass the tangible demands of space and enrollment and the less concrete ramifications of creative design and human interaction. The campus planner must coordinate large quantities of data exhibiting complex interrelationships to design facilities that are economical and aesthetically pleasing and that meet administrative expectations.

Perhaps the most exciting benefit the educational planner can derive from the proper application of computer aids is the ability to evaluate in detail a variety of alternative building solutions. Computer simulation models permit the planner to build, destroy, and reallocate space at will, thereby allowing any given solution to be examined and the multiple variations of its components explored long before funds must be committed to actual construction. In addition, the computer can supply descriptions of the benefits, costs, steps involved, and miscellaneous details contingent to a proposed design.

The literature reviewed here indicates a concern for a better definition of the processes and contexts in which computer simulations might be used and for the further development of programs for evaluating computer applications. Other directions of the research include the expansion of space inventory files, the clarification of methods employed in their gathering, a larger-scale effort in the collection of

student and faculty data, and the development of more efficient activities and space use simulation models.

All but two of the documents reviewed are available from the ERIC Document Reproduction Service. Complete instructions for ordering these documents are given at the end of the review.

COMPUTERS FACILITATE COLLEGE DESIGN

Computer simulation facilities of a nearby aerospace contractor were utilized by the Saint Louis Junior College District (1964) to develop a master schedule for facility planning. Projected enrollments and course offerings were programmed with idealized student-teacher ratios to project facility needs. The computer simulation showed that one-third less instructional facilities were needed than studies of current scheduling practices in other states had indicated. A computer study costing $15,000 saved about $3,000,000 in building costs for one campus. Analysis standards and methods used in the computer scheduling program General Academic Simulation Program (GASP) are described.

Meier (1967) describes a computer program undertaken at the University of Washington to develop period-by-period estimates of future land, building, and staff requirements under various assumptions about student body characteristics, educational policies, level of research activity, level of service to the community, and character of buildings. The program projects variables affecting staff and facilities requirements and produces estimates of requirements at any projected time in the future. Coding an experimental computer program, coding the main computer program, and assembling input data for the program were major activities in the project. At the time of Meier's report, the computer program was not completely written.

Sedrel and Richardson ([1967]) describe the increased efficiency and cost-reduction benefits derived from use of the Facilities Utilization Analysis Program (FUAP). Facility usage is analyzed by establishing relationships between factors of space capacity and space occupancy. Four formulas determine room utilization by time period, total room utilization, building utilization by time period, and total building utilization. The program will analyze from one to two hundred spaces, categorized by type of space, for each time period of the school day. The program is written in Fortran IV and requires a memory capacity of fifteen thousand words. Required input data include type description, room description, and room use. From three to eighteen output tables are possible.

A computer model developed to assist space administrators at the University of Toronto in planning classroom requirements is presented by Sceviour (1968). The requirements generated are compared against available rooms and measures of utilization that were computed. The model reacts to changes in the parameters describing the system, which allows the resource implications of alternative space planning decisions to be considered.

The Comprehensive Analytical Method for Planning in the University Sphere (CAMPUS) is the simulation model employed by

Sceviour in his studies at the University of Toronto. Hansen and Barron (1966) provide a small orientation model of that system to demonstrate its capacity for processing projected enrollment statistics and other necessary information to yield time-based estimates of academic and nonacademic staff and space requirements. In addition, CAMPUS can detail the various categories of expenses encountered in large university operations. Simulation results take the form of output data containing space, staff, and budget information and changes caused by the input of certain "what if" questions.

Weston and Oliver (1968) describe the space inventory procedures and the space utilization records and system in use at the University of Michigan. Examples of earlier attempts at space records precede an outline of the present computerized system. The outline includes data gathering, computer reports (space inventory and use, and teaching room utilization), computer programs, and the summary report to management. A sample room utilization record, space utilization survey instructions, space utilization survey room-type code list and function definitions, and sample space inventory and use reports appear in the appendixes.

WISCONSIN UNIVERSITY STUDIES

In a paper presented at the 11th Machine Records Conference, Witmer (1966) reported that Wisconsin State universities have been using the computer as a management tool to study physical facilities inventories, space utilization, and plant and enrollment projections. His presentation describes the card format, coding systems and printouts for the different types of computer analysis required by a university. Witmer notes various implications for the use of computers and computer-related techniques within the planning process and provides equations for dealing with class enrollment projections and obtaining both standard and potential space utilization information. Problems discussed include computer applications in space conversion, laboratory and library planning, office space, and departmental organization.

Yurkovich (1966) provides a detailed treatment of the computer methodology for determining facilities requirements that was implemented and tested at the University of Wisconsin. His discussion surveys the development, implementation, and testing of systems for classifying space, maintaining a perpetual space inventory, and conducting room utilization studies. The systems were also used to project student enrollment by a set of defined measures, project number of staff and their space needs, integrate structured input data, and determine the institution's future facilities needs. Appendixes include code lists, data reports, detailed guides, flowchart representations of the systems, and supportive information pertinent to space management and planning.

Schwehr and Schwehr (1967) point out that the studies carried on at the University of Wisconsin can readily provide comparable data in the reporting of existing facilities or in the biennial projection of facility needs for any university. They describe a system of space classification that unifies definitions of room types, subject fields, and function classifications for statistical studies at the state or national levels. Their report includes methods of collecting data for the inventory and utilization studies, a format for presenting the desired information output, and a plan for implementing the inven-

tory and utilization information. Although the manual presents a computerized method of analysis, the procedures may be easily converted to manual analysis techniques for use in smaller institutions.

EFL-Duke University Maximizes Benefits to Reduce Costs

A project sponsored jointly by the Educational Facilities Laboratories (EFL) and Duke University to develop and demonstrate computer applications in campus planning receives attention in a paper presented by Robert Mattox (1967). In addition to defining the parameters of a campus planning process, the study identifies kinds of necessary information and how data can be organized for computer simulation models. It also explores computer simulation testing of alternative building solutions whereby cost and utilization factors can be compared within the overall requirements of campus planning.

Recognizing that the most difficult area of the planning process centers about the nonscheduled student activities of study, research, and recreation, the project employed detailed student diaries to establish traffic patterns and provide relevant data for computer analysis.

Primary areas of concern include time spent in a specific activity, traffic activities and related variables (cost, flow distribution, etc.), and projection of future campus activity-space relationships. The various activities proposed by the planners must be correlated with these areas before long-range effects can be identified.

The EFL documents surveying the phases of the project are arranged in four volumes. The first (1969a) provides an overview of planning information needs of an institution of higher education and an approach to the collection of appropriate activity and facility data. Emphasis is given to space management and activities data with regard to facilities planning effectiveness. A computer program for evaluating alternative building programs is described and data input requirements are set forth and related to the activities and facilities data.

The second volume (1969b) presents methods for developing an inventory of the existing space on a given campus and identifies the responsibilities and modes of operation of the room inventory office. Appendixes include an implementation manual for maintaining the system at Duke University.

The third volume (1969c) relates data collection and analysis procedures to the project's measuring system for gauging the level of space-demanding activities on the campus. Preliminary analysis techniques and samples of the forms employed in that phase of the project are included.

The last volume (1969d) focuses on space planning as a technique for evaluating alternative building programs. A computer-based mathematical model simulates the institution's use of facilities. Program inputs, measures of effectiveness, and program procedures are included with sample forms and relevant output materials.

The EFL-Duke University studies provide the basis for a second paper by Mattox (1968) on the computer analysis of scheduled and nonscheduled activities. In this paper he specifies the data necessary for analyzing campus space needs as including total enrollment figures, distribution of majors, distribution of class time to departments, and department loads. Other distribution factors are lecture and lab relation-

ships, class enrollment, and class size or activity as formulated by departments. Mattox identifies primary computer functions in the planning process as the processing and displaying of information, the expressing of relationships among components, and the modeling of changes and effects of planning decisions.

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